

sition in Chicago, Ill., and there suggested that famine years in India are generally years of low flood in Egypt, and that when the summer supply of the Nile had been deficient and late, a high flood might well follow, since the drought in the valley of the White Nile must create a powerful draught<sup>2</sup> from the Indian Ocean or the Arabian Sea, a district in which is to be sought the origin of the massive currents of the southwest monsoon. Unfortunately, any exact data to establish this interesting connection are not forthcoming, and can hardly be expected, since the Nile is supplied from two distinct sources, and it is impossible to separate and trace the effect of either contribution. Of the great lakes of central-east Africa which constitute a reservoir for the Nile waters, little is known as to the variation in their relative height due to the rainfall in their vicinity, which lasts from March to December. At Port Alice, on the Victoria Nyanza, and at some other stations, observations, more or less regular, are made of the variation in the heights of the water, but in the absence of any common datum level these heights are referred to that of the mean lake. Much surveying work and long continued observations will have to be made before these scanty statistics can be turned to full account.

Of the second source of supply to the Nile, viz, the flood waters in the Atbara, the Blue Nile, and other rivers, fed during the rainy season from June to November, we know practically nothing as to their amount. But it is this seasonal supply which is probably the greatest factor in causing variations in the Nile floods, and where a connection with the causes of the Indian rains is closest. Whatever influences the flow of the monsoon current from the equator northward over the Indian seas toward the heated regions of India and Malay Peninsula, must have a proportional effect on east Africa and south Arabia. With heavy monsoon rains, therefore, it is not unlikely that the contributing rivers add materially to the volume of the Nile waters, but it is not altogether a trustworthy guide to gage the amount of water that enters the Nile by measuring the quantity that passes a particular station. Much water enters the Nile that never contributes to the irrigation of Egyptian lands. Of the amount lost by evaporation no account can be taken, but a source of greater error arises from the peculiar flatness of the ground about Shambé, which forms the apex of the swamp delta. Here the Nile can spread its waters over a large area, and practically lose itself as a river among the beds of reeds and rushes which form a veritable swamp. Engineering works, already projected or actually begun, aim at clearing some or other of the feeding streams, such as the Bahr el Gebel or the Bahr el Zarab, and the effect must be, when completed, to break the continuity of such observations as have been made. Other sources of error are to be found in the varying quantity and character of the "sudd" which may interrupt the flow or diminish the amount of evaporation, but without insisting on too much accuracy there exists a certain amount of evidence that the two great agricultural countries of Egypt and India are likely to be prosperous together or to suffer in common.

Having mentioned some of the causes which prevent a rigorous comparison between the Nile floods and the Indian rainfall, one is not unprepared to find some discrepancies, but Mr. Eliot certainly does not overestimate his case when he contends that these tables indicate that in at least four out of five seasons in which there was a partial failure of the rains in India there was a low Nile, and that generally the two countries are similarly affected by the meteorological conditions and the variations of those conditions. The causes of these variations are obscure, and at present very

imperfectly recognized, for a complete solution, as Mr. Eliot points out, demands a much more intimate knowledge of the atmospheric conditions that prevail over a large area. The meteorology of Australia and the Indian Ocean, and perhaps also of the Antarctic Ocean, must be linked to that of the Indian monsoon area "before it will be possible to ascertain the missing factors necessary to complete the explanations of the relations between the chief features of the monsoon currents and rainfall of India and the antecedent and concurrent conditions in the Indian area and the regions to the south." To trace and anticipate the effect of weather conditions over the area that embraces both India and Egypt, in which our interests are so largely involved, should stimulate further inquiry, with the result of placing at the command of science additional means for dealing with so grave a problem.

Mr. Eliot, the meteorological reporter to the government of India, in his recent forecast of the probable character of the southwest monsoon rains of 1900, not only fully indorses Mr. Willcocks's statement, but adds some statistics which render a connection highly probable. Omitting a few local particulars from Mr. Eliot's statistical summary, the broad features are shown in the following table.

Year.	Departure of mean annual Indian rainfall from normal, in inches.	Character of Nile flood.
1876.....	- 4.49	Good, high flood.
1877.....	- 4.28	Poor flood.
1891.....	- 3.54	Late flood.
1896.....	- 4.83	Low Nile.
1899.....	-11.14	Very low flood; lowest of century.

The years of excess of Indian rainfall tell a similar tale even more distinctly.

Year.	Rainfall departure, in inches.	Character of Nile flood.
1878.....	+ 6.34	Very severe flood; banks of river carried away in October.
1886.....	+ 3.02	High flood.
1892.....	+ 5.09	Very high and late flood.
1893.....	+ 9.07	High flood.
1894.....	+ 6.47	High flood.

#### METEOROLOGICAL OBSERVATIONS DURING THE BURNING OF THE PLANT OF THE STANDARD OIL COMPANY AT BAYONNE, N. J., JULY 5, 6, AND 7, 1900.

By W. H. MITCHELL, Secretary of the Bayonne Kite Corps.

A little before midnight on July 4, a heavy thunderstorm broke over Bayonne, the rain coming down in torrents flooding the streets, as the sewers were incapable of draining the sudden downpour. The lightning was the most vivid witnessed here this year. At 12:15 a. m., on the 5th, came a blinding flash that, to the surprise of those who saw it, continued to illuminate the sky. The crash of the thunder that followed was augmented by an explosion that shook every house in the city, and it was difficult to distinguish which was thunder and explosion, so simultaneously did the reports take place.

Almost immediately the special fire whistles of the Standard and Tide Water Oil companies called the day men of both companies to the works, and the general alarm of the Bayonne fire department followed, calling out six steamers, eight hose carriages, two trucks, and 450 men, of whom some 300 responded.

The writer, being a member of the department, responded at once, arriving on the scene at 12:35. The officers of the oil company and the fire department at once realized that

<sup>2</sup>The indraught due to such drought must be inappreciable. A drought in the valley of the White Nile is the result of the cessation of the inflow of air from the Indian Ocean.—Ed.

they had a fight on their hands that would last, not for hours, but for days.

The storm that was raging at the outbreak of the fire, with its thickset clouds, the heavy, black smoke from the burning oils, at the time principally crude, with the darkness of the night and the flood of rain lit up by the brilliant flames, made a scene seldom witnessed.

The flames, drawn by the increasing draught of the fire, rose several hundred feet in the air, while large quantities of gas generated in the smoke column would every few minutes take fire and apparently add to the altitude of the flames.

The officer who turned in the alarm for the department told the writer that, after striking the two large tanks in the oil yard, the lightning appeared to travel along some pipes that ran near to a two-story frame building on the north and opposite side of East Twenty-second street, setting fire to this as well.

When daylight arrived, it having cleared before dawn, the true magnitude of the fire could be observed, but the great height of the smoke column could not be appreciated except from a distance.

At this time, 7 a. m., there was apparently but little wind for the smoke rose almost vertical and spread out into a huge umbrella-shaped cloud whose inky blackness is hard to appreciate unless one is familiar with oil fires, the form of the cloud indicating but little wind aloft.

That the air on the surface was drawn toward the center of the burning district is shown from the fact that the vanes on the flag pole of public school No. 5 and Enterprise Hose Company No. 1 were showing a northwest wind, these buildings being about one thousand feet from the fire. The vanes on two churches still further to the northwest told the same story. The "telltale" on masts of vessels at the tide water wharfs, one-half mile southwest of fire, indicated a southwest breeze.

The true wind seems to have been almost due north at this time. It was impossible to get an observation to the eastward, but I feel positive that a half mile from shore a vane would have pointed to the eastward.

Ever since the publication by Professor Fergusson, of the Blue Hill (Mass.) Observatory, describing the formation of cumulus clouds above large conflagrations, the members of the Bayonne Kite Corps have been waiting for a chance to observe the same phenomena, knowing that sooner or later the opportunity would be afforded by a really big fire in this vicinity. At 10 a. m. on the 5th, three tanks exploded in succession, two being on the opposite side of the street (East Twenty-second). The explosion drove every one within 300 feet still farther away for the moment, yet men working within 50 feet escaped without burns. The flames swept directly over No. 2 engine, which was at once abandoned, but was immediately rescued by members of Nos. 3 and 4.

Immediately after this triple explosion a whirlwind was formed not less than 300 feet in diameter where it touched the earth. The suction force of this whirl lifted not only scrap paper, but small pieces of wood and empty tin cans, which could be seen high in the air till they were lost to sight in the smoke and probably dropped afterwards in the fire. The duration of this whirl was probably not over five minutes.

The writer was excused at noon on the 5th, after twelve hours duty, to go home for rest and refreshment, after which he took an observation to ascertain the altitude of the smoke column above the kite station ( $1\frac{1}{2}$  mile distant from fire, as shown by the charts of the Hydrographic Office), by triangulation,<sup>1</sup> obtaining the very steep angles of  $42^{\circ} 15'$  and  $41^{\circ} 15'$ ,

<sup>1</sup> In a separate letter Dr. Mitchell explains that by means of quadrants held in the hand and with plain sights the two observers at 528 feet distant simultaneously observed the vertical angles  $42^{\circ} 15'$  and  $41^{\circ} 15'$ , whence the altitude of the cloud is as given by him. The same method is used in determining the altitude of the Bayonne kites. The observed angular elevations are probably accurate to within  $15'$  of arc.—Ed.

with a base line of 528 feet, showing that the smoke column was over 13,000 (13,411) feet high.

It was then, 3 p. m. of the 5th, that I noticed that the white clouds were forming on the top of the smoke column, and several photographs were taken.<sup>2</sup> An idea of the immense size of the column of smoke can be better understood from the fact that it was found impossible with a 4 by 5 camera to get the entire cloud of smoke on the plate.<sup>3</sup>

These photographs show the large white fleece-like clouds resting on the top of the smoke column that did not disappear for the next two days. Leaving instructions to have several more photos taken from various points in the neighborhood of the kite station (East Fourth street and Lexington avenue), the writer returned to the fire. At 9 p. m. he was again excused, as only the hose manned by the oil company's employees engine crews were needed.

At 10:30 p. m. of the 5th, a tank containing what is known to the oil trade as "gas oil," exploded. The writer had but just arrived home from the fire. The force of the explosion shot the gas not less than 3,000 feet into the air; the illumination was so bright that a newspaper could be read three miles away. The heat was distinctly felt by the writer at one and one-quarter miles, and Mr. Willard W. Hotchkin and Mr. Henry L. Allen, of the corps, report noting the heat from a point half a mile farther away. Those in the immediate vicinity of the burning tanks, but not too close, did not feel the heat as much as those who were at a greater distance.

All day of the 6th the smoke column floated at about the same altitude as on the 5th, but during the morning hours the white clouds could not be observed from the writer's point of view (to westward), but as soon as the sun had passed meridian they again became visible and continued so till sundown.

About 7:30 p. m. on the 6th, it being the second day of the fire, a thunderstorm arose in the northwest, being preceded by a high wind of hurricane force. This wind knocked the smoke column over, carrying it well inland on Staten Island, crossing the Kill van Kull, on which during this storm navigation must have been more dangerous than in the densest fogs. This zone of smoke, where it crossed the Kill van Kull, was not less than a half-mile in width, and was perceptible at Richmond five and one-half miles away. It could not rise at its greatest, more than 200 feet, while at the fire it swept horizontally to the southward.

The rain came down in torrents for a half hour, after which it cleared, and the illumination of the preceding night was continued.

Daylight on Saturday, the 7th, revealed the column of smoke still floating, apparently as high as on the two preceding days.

By noon the fire had been so confined that the Bayonne fire department was dismissed after fifty-six hours continuous duty. To observers the great column of smoke indicated that the fire was still raging with unabated fury, but this smoke came from one huge tank of solid paraffine wax, which was allowed to burn itself out, which it did about 5 p. m.; and about 6:30 p. m. it again clouded up and another thunderstorm broke with the same violence as on the preceding evening. However it did not have as much smoke to play with, and blew the flames only over the burned district.

On Sunday, the 8th, no unusual smoke was visible from our kite station at Bergen Point.

On Monday, the 9th, while cleaning up the debris, the

<sup>2</sup> Unfortunately these photographs do not furnish satisfactory half tones and are therefore not reproduced.—Ed.

<sup>3</sup> Camera used was a Ray No. 1 Bausch and Lomb rapid rectilinear lens that cuts forty degrees sharp to corners of plate, diaphragm No. 16, focal length of lens  $5\frac{1}{2}$  inches.

workmen uncovered a quantity of oil, and the flames broke out, forming a smoke column some 300 feet high that hung over the ruins all that day. The yard men kept streams on the ruins till the 12th.

It must be observed that these tanks were, most of them, 90 feet in diameter, 35 feet high, and contained about 30,000 barrels each of crude, refined oil, gasoline, solid wax, and tar, respectively, in all 16 were destroyed, with other property.

There seems to be more than one lesson to be taught by these large conflagrations. From the study of the meteorological disturbances in the atmosphere while such large quantities of heated air and gases are ascending for several days without cessation, we learn:

1. The surface winds are drawn toward the center of such a fire for a distance of over one-half mile, as was shown by all vanes pointing away from it within that distance.

2. That there is a limit to which smoke will ascend even when carried up by heated air and gases, as shown by the way it spread out into the umbrella-like form.

3. That Professor Fergusson's observation<sup>4</sup> that cumulus clouds are formed was proven in that except for those over the smoke column the sky was mostly cloudless, while at times the smoke was crested with them.

4. What influence did the fire exert on the atmosphere? Was it responsible for the two local thundershowers that took place on Friday and Saturday at about the same hour—7:30 and 6:30 p. m.

The following data is furnished by Mr. Willard W. Hotchkin, Volunteer Observer at the Bergen Point Station, N. J. Weather Service:

Date.	Barometer.		Thermometer.		Hygroscope.		Rainfall.		Wind direction and velocity.	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	P. M.	
1900.	<i>Inches</i>	<i>Inches</i>	°	°		%				
July 4 .....	29.98*	30.00	74	71*	95*	95*	1.30	0.08	nw.	18
5 .....	30.10	30.00	74	74	76	76	0.08	0.08	sw.	8
6 .....	29.95	29.90	75	74	90	90	0.54	0.54	sse.	Light.
7 .....	29.90	29.90	79	73	82	82	0.06	0.06	sw.	Light.

\* On July 4, midnight. All other records are taken at 7:30 a. m. and 7:30 p. m.

## RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

*Nature*. London. Vol. 62.

Darrison, Charles. The Distance to which the Firing of Heavy Guns is Heard. P. 377.

*Nature*. London. Vol. 62.

Hughes, T. McK. Snowdrifts on Ingleboro in July. P. 389.

— Nile Floods and Monsoon Rains. P. 391.

*Nature*. London. Vol. 62.

Halm, J. Latitude Variation; Earth Magnetism and Solar Activity. P. 460.

*Symons's Meteorological Magazine*. London. Vol. 35.

Wilson, Albert. The Cloud-burst of Rombald's Moor. P. 97.

*Annalen der Physik Leipzig*. Vierte Folge.

Ebert, H. and Hoffmann, B. A. Elektricitätsregung in flüssiger Luft. P. 706.

<sup>4</sup>Clouds above fires have been recorded many times in the early annals of meteorology, e. g., in America by Mitchell and Espy; in Europe, by Kamtz.

*Annuaire de la Société Météorologique de France*. 47<sup>me</sup> année.

Raulin, V. Observations d'évaporation dans l'Empire russe. P. 181.

Coeurdevache. Evaporation suivant la température, l'état hygrométrique et la vitesse du vent. P. 186.

*Popular Science Monthly*. New York. Vol. 57.

Lucas, Frederick A. Birds as Flying Machines. P. 473.

Groff, George G. Conquest of the Tropics. P. 540.

*Deutsche Mechaniker-Zeitung*. Beiblatt zur Zeitschrift für Instrumentkunde. Berlin.

Fischer, Karl T. Ein neues Barometer. [From *Physikal. Zeitschr.*] P. 127.

*La Géographie*. Paris. 1900.

— La météorologie en Roumanie. P. 131.

*Himmel und Erde*. Berlin. 12 Jarg.

Rubner, Professor. Kampf um die Gesundheit im XIX Jahrhundert. (Fortsetzung) Wärmeverhältnisse. P. 504.

*Journal of the Western Society of Engineers*. Chicago. Vol. 5.

Seddon, James A. Reservoirs and the control of the lower Mississippi. P. 259.

*Philosophical Magazine*. London. Vol. 50.

Stevenson, J. Chemical and Geological History of the Atmosphere. P. 312.

*Memorias y Revista de la Sociedad Científica "Antonio Alzate"*. Mexico. Tomo 14.

Moreno y Anda. L'Insolation dans nos Climats. P. 265.

Descroix, L. Sur la discussion mathématique des séries d'observations météorologiques. P. 295.

*Gaen*. Leipzig. 34 Jarg.

Reinicke. Vergleichung der Falb'schen Prognosen mit dem in Deutschland thatsächlich eingetretenen Wetter im meteorologischen Jahre 1898-1899. P. 606.

— Der erste Aufstieg des Zappelinischen Luftschiffes. P. 615.

*Das Wetter*. Berlin. 17 Jarg.

Assman, R. Aus dem Aëronautischen Observatorium des k. meteorologischen Instituts. (Schluss.) P. 169.

*Scientific American*. New York. Vol. 83.

Michaud, G. The Climate of our New Possessions [Cuba, Porto Rico, and the Philippines]. P. 171.

*La Nature*. Paris. 28<sup>me</sup> Année.

Derome, J. Les Progrès de la Télégraphie sans Fils. P. 242.

*Nederlandsch Tijdschrift voor Meteorologie*. 1 Jaargang.

Buijsman, M. Het klimaat en de plantengroei van Canada. P. 33.

Nell, Chr. A. C. Twee Merkwaardige Halo's. P. 39.

Kassner, C. Uitkomst van Waarnemingen over Golf-Wolken. P. 41. [From *Met. Zeit.* 1900.]

Nell, Chr. A. C. Hoe Ver Kan Men den Donder Hooren? P. 45.

Monne, A. J. Een Wolkhoos. P. 46.

Red, N. T. v. M. Waargenomen Kapvorming Bij Cumulus. P. 47.

— Hagel te Congo. P. 47.

## MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletín Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for August, 1900.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	Inch.	° F.	° F.	° F.	%	Inch.		
Arteaga (Coahuila) ..	92.3	64.4	75.9	62	1.60	e, sw.	e.		
Durango (Seminario) ..	6,243	24.09	89.6	50.0	68.9				
El Labrador (Coah'a) ..			84.2	61.7	70.5				
Gran Cepeda (Coah'a) ..			95.9	60.8	73.9				
Leon (Guanajuato) ..	5,934	24.35	83.5	55.8	67.3	74	7.15	s.	e.
Mazatlan ..	25	29.89	91.4	72.7	85.1	73	2.01	nw.	ne.
Mexico (Obs. Cent.) ..	7,472	23.10	78.1	52.7	63.0	68	3.66	n.	ne.
Morelia (Seminario) ..	6,401	24.03	76.8	55.2	64.4	76	3.32	sw.	e.
Parras (Coahuila) ..	3,986		91.8	67.1	75.7				
Puebla (Col. Cat.) ..	7,112	23.27	80.2	49.1	67.3	78	6.66	ene.	ne.
Saltillo (Col. S. Juan) ..	5,399	24.82	87.1	58.6	70.2	73	7.30	n.	se.
Zapotlan (Sem.) ..	5,078	25.14	82.8	59.0	69.1	75	9.22	n.	e.